Westside Restoration Project

Hydrology Report

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for:
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Introduction

Proposed activities for the Westside Restoration Project include timber harvest, post-harvest fuels treatment (controlled burning and piling), regeneration planting, natural fuels burning, and road system modifications (temporary road construction, existing road reconstruction and maintenance, and road storage and decommissioning), including replacing culverts that are barriers to aquatic organisms. The focus of this report is to document existing conditions of hydrologic resources and associated aquatic habitat in the project area and to analyze potential environmental effects of the proposed activities. A description of the project area, purpose and need, and proposed project alternatives can be found in the Westside Restoration Environmental Assessment (EA).

Relevant Laws, Regulations, and Policy

Regulatory Framework

Land and Resource Management Plan

The Idaho Panhandle National Forests Land and Resource Management Plan (the Forest Plan) guides all natural resource management activities and establishes management direction for the Idaho Panhandle National Forests. The 2015 Forest Plan includes direction for the maintenance and improvement of water quality and aquatic habitats. The Inland Native Fish Strategy (INFS) amended the Forest Plan direction regarding stream and fish habitat protection measures and was updated in the 2015 Forest Plan to include the restoration emphasis that was lacking in INFS and also clarified INFS direction as either standards or guidelines. Plan components that may be applicable to the watershed, soils, riparian, aquatic habitat, and aquatic species resources are found on pages 22-29 of the plan.

Coeur d’ Alene Resource Management Plan

This plan guides all activities that occur on lands managed by the Bureau of Land Management. The following items pertain to water resources:

Goal WA-1 – Maintain, improve, or restore water quality to sustain designated beneficial uses on public lands.

Objective WA-1.1 – Comply with state and federal requirements to protect public waters.

Action WA-1.1.1 – Prescribe and implement BMPs to reasonably prevent degradation

of water quality (Appendix C). Available online at http://go.usa.gov/xpfpc.

Objective WA-1.2 – Protect and maintain watersheds so that they appropriately capture, retain, and release water of quality that meets or exceeds state and federal standards.

Action WA-1.2.1 – Implement CNFISH management direction in Appendix A.

Federal Law

Clean Water Act

The Clean Water Act requires the states and tribes restore and maintain the chemical, physical, and biological integrity of the nation's waters. Stipulations in the Clean Water Act require the Environmental Protection Agency (EPA) and the States to develop plans and objectives that will eventually restore identified stream segments of concern. The Clean Water Act (CWA) requires all water bodies that are deemed to be not fully supporting their beneficial uses by the state (Idaho) be brought onto the 303(d) list as water quality limited. For waters identified on this list, states must develop a Total Maximum Daily Load (TMDL) for the pollutants set at a level to achieve water quality standards.

National Forest Management Act

Section 6 of NFMA provides language to "insure that timber will be harvested from National Forest System lands only where; soil, slope, or other watershed conditions will not be irreversibly damaged; protection is provided for streams, stream-banks, shorelines, lakes, wetlands, and other bodies of water from detrimental changes in water temperatures, blockages of water courses, and deposits of sediment, where harvests are likely to seriously and adversely affect water conditions or fish habitat; and that such [harvests] are carried out in a manner consistent with the protection of soil, watershed, and fish, resources.

Executive Orders

Protection of Floodplains, Executive Order 11988

Requires federal agencies to avoid to the extent possible the long and short-term adverse impacts associated with the occupancy and modification of flood plains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative.

Protection of Wetlands, Executive Order 11990

Directs federal agencies to provide leadership and shall take action to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands in carrying out the agency's responsibilities for conducting Federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulating, and licensing activities.

State and Local Law

Idaho Forest Practices Act

The Idaho Forest Practices Act regulates forest management on all ownerships in Idaho, including National Forest System lands (Title 38, Chapter 13, Idaho Code 2000).The Forest Service has agreements with the state to implement best management practices (BMPs) for all management activities. All activities would meet or exceed guidelines described in the Soil and Water Conservation Handbook (Forest Service Manual 2509.22).

Idaho Stream Channel Protection Act

The Idaho Stream Channel Protection Act requires that the stream channels of the state and their environment be protected against alteration for the protection of fish and wildlife habitat, aquatic life, recreation, aesthetic beauty and water quality. The Stream Channel Protection Act requires a stream channel alteration permit from Idaho Department of Water Resources before any work that would alter the stream channel may begin.

Topics and Issues Addressed in This Analysis

Resource Indicators and Measures

Table 1. Resource indicators and measures for assessing effects to hydrology.

Resource Element	Resource Indicator	Measure (Quantify if possible)
Water Quality	Sediment Delivery	Amount of sediment delivery to project streams (tons/year)
Water Quality	Temperature	Riparian vegetation preserved or improved (acres)
Watershed Function	Road Density	Miles of road per square mile (mi/ mi^2)
Watershed Function	Equivalent Clearcut Area	Acres

Water Quality

Sediment Delivery

Sediment yield to streams is a natural process and includes events such as landslides and wildfires. These events can deliver tremendous amounts of sediment but are stochastic in nature and occur infrequently over time. (Moody & Martin, 2009) reviewed post-wildfire literature and found mean sediment delivery amounts from hillslopes of 82 tons/ha with even larger yields from channels. Aquatic ecosystems on the forest have evolved within the context of these kinds of stochastic events, e.g. the wildland fires of 1889 and 1926 which burned the majority of the project area watersheds.

Random sediment inputs to stream channels occur as a complex series of pulses that are delivered and stored within low order, high gradient stream channels (Benda & Dunne, 1997). Sediment accumulates for centuries within these channels before being transported or "flushed" downstream by episodic events with large increases in water yield (Kirchner et al., 2001). Transport of sediment plays a fundamental role in the natural function of forested watersheds. In excess, suspended sediment degrades aquatic and fish habitat, disrupts hyporheic connection, enhances the transport of sorbed pollutants, and increases treatment costs associated with municipal water withdrawal (Rehg, Packman, & Ren, 2005).

Forests generally have very low erosion rates unless they are disturbed (W. J. Elliot, Hall, & Scheele, 2000). Common disturbances include timber harvest operations, roads, prescribed burning, and wildfires. Impacts to soil erosion from these activities last a few years before rapid revegetation covers the surface with protective plant litter (William J. Elliot, 2004). However, not all impacts to soil erosion are short lived. Numerous research studies have documented that forest roads are usually the leading contributor of sediment to stream channels (Bilby, Sullivan, & Duncan, 1989), (Gucinski, Furniss, Ziemer, & Brookes, 2001).

Forest roads can be chronic sources of sediment because; road construction, use, and maintenance compact soils, reduce infiltration, intercept and concentrate surface and subsurface runoff, and limit growth of vegetation. Road ditches can be a direct conduit of sediment from ditch and road erosion into live water bodies. Also, roads can increase the frequency and magnitude of mass wasting (i.e. landslides) by one of several ways:

- Improper alignment can undercut the base of unstable slopes.

- Roads can intercept, divert, and concentrate runoff to sections of the hillside that are unaccustomed to overland flow causing soil saturation and slope failures.
- Culverts and other drainage structures can become plugged with debris and the subsequent flow over the road surface can cause failures.

If roads are located on sensitive landtypes, the probability of failure is increased. All of these characteristics can lead to a negative effect on aquatic resources.

While some amount of sediment delivery may not be inherently detrimental to aquatic resources, sources of sediment from anthropogenic activities can be controlled and should be addressed where necessary. The most common source of sediment in the project area, resulting from anthropogenic activities, is from roads. Sediment from roads tends to be of a size which has more ecologically damaging properties. While sediment contributions from roads may be relatively minor component compared to landscape scale sediment regimes, roads are areas where sediment delivery effects from management activities can be reduced.

Water Temperature

Water temperature has a profound effect on organisms that live or reproduce in the water, particularly Idaho's native coldwater fish such as westslope cutthroat trout and some amphibians (frogs and salamanders). When water temperature becomes too warm, trout suffer a variety of ill effects ranging from decreased spawning success to death. Most streams naturally warm as they flow from their headwaters to their mouth.

Elevated stream temperatures can result from both natural and human-caused events. Land management (human activity) can increase stream temperatures by removing vegetation along streambanks, which reduces the amount of shade over the water thereby increasing the amount of solar radiation reaching the stream. Stream temperature can also be elevated by excessive sedimentation (i.e., build-up of boulders, rocks, gravel, sand, dirt, and silt), which results in a stream becoming wider and shallower, making it harder to shade and easier to heat. Sediment is a natural part of a stream system, but land management activities like road building, agriculture, forestry, and urban development can increase the amount of sediment entering a stream, delivering higher amounts of sediment than the stream can handle.

The surrogate measure for water temperature is area of riparian vegetation preserved or improved is used because direct incoming solar radiation is the dominant energy input for increasing stream temperatures with shade being the single most important variable to reduce this heat input (Cobb, 1988), (J. A. Gravelle & Link, 2007), (Krauskopf, Rex, Maloney, & Tschaplinksi, 2010).

Watershed Function

Road Density

Road densities can provide a relative measure of road-stream interaction and the relative risk for increased flows and sediment input into the hydrologic system. Road density is sometimes used as a proxy for impacts to streams and watersheds and has been shown to generally reduce fisheries composition and persistence with higher densities. A review of research in Idaho and elsewhere concluded that non-channelized runoff from roads has a low probability of traveling further than 300 feet (Belt, O'Laugblin, & Merrill, 1992), (Burroughs & King, 1989). Road densities located within 300 feet of streams are at greater risk for flow modification and sediment loading. The number of road miles is calculated from GIS information and includes all roads on the system, whether open for public motorized use or for administrative use only. Decommissioned or previously stored roads were not included in the density calculations because they have been treated to reduce impacts to hydrology (i.e. ditches drained frequently by waterbars, culverts removed, etc.).

Equivalent Clearcut Area

Watershed processes are very complex and exist with large amounts of natural variability. Generally, removal of forest canopy through stand-consuming fires, forest insects and disease, or timber harvesting can increase water yield and modify hydrographs. (Hubbart, Link, Gravelle, & Elliot, 2007), conducting their research in northern Idaho, detected increases in water yield after partial cut harvesting during the snowmelt season but found no difference in the summer base flow period. (Coble et al., 2020), studying the same watersheds, found slight increases to baseflows immediately after harvest, with values returning to normal after about twenty years. The same study also found that the magnitude of low flow changes decreased as the watershed size increased. However, many researchers have documented high variability in discerning relationships of the percent of a watershed harvested and changes in peak flows (Grant, Lewis, Swanson, Cissel, & McDonnell, 2008). There are many past events such as wildfire, timber harvest and road building activities within the watersheds that impact water resources. Equivalent clearcut area (ECA) modeling can be performed to assess the level of impacts from past and proposed harvest activities. Such an analysis is a tool used to assess potential increases in areas of canopy removal from past and proposed activities such as clearcuts, partial cuts, road building and decommissioning, and burned areas within the project watersheds. ECA, when above a certain threshold (discussed in the methodology section) can also be related to changes to water yield and peak flows.

Methodology

The objective of this analysis is to disclose the potential effects of the project activities on watershed resources. Changes to sediment delivery, stream temperatures, and watershed function were used to evaluate potential effects on watershed resources.

The analysis begins with a description of the affected environment that characterizes the drainages within the project area and the aquatic resources found there. The affected environment section establishes a reference condition, providing insight into historical patterns and processes, and providing a basis for predicting the effects of natural and human disturbances. This section includes establishment of the existing condition where effects of past activities and natural events that have influenced the aquatic resources can provide a baseline against which effects can be evaluated.

The environmental consequences section begins by examining the potential direct and indirect effects of proposed activities on watershed resources through analysis of changes in water quality and watershed function. This section includes an evaluation of potential cumulative effects. The cumulative effects analysis combines direct and indirect effects with effects of past, present, and reasonably foreseeable activities throughout the project area watersheds.

Information Sources

Literature and Office Review

Background and supporting information for this report was gathered from Forest Service fish and hydrology files, geographic information system (GIS) data, historical records, aerial photographs, and published and unpublished scientific literature. Research for this project included discussions with the Idaho Department of Environmental Quality. Also, a transportation analysis process (TAPS) was completed in 2020 that provided recommendations for long-term road management objectives within the project area.

FS WEPP – Forest Service Water Erosion Prediction Project

Several FS WEPP online interface tools were used as a means to predict and compare sediment delivery from physical disturbances such as wildfire, road construction and maintenance, timber harvesting, and prescribed burning. These models and supporting documentation can be found at: http://forest.moscowfsl.wsu.edu/fswepp/. The WEPP model is a physically based soil erosion model that provides estimates of soil erosion and sediment yield considering site-specific information about soil texture, climate, ground cover, and topographic settings (W. J. Elliot et al., 2000).

FS WEPP: Road is a set of interfaces designed to allow users to quickly evaluate erosion and sediment delivery potential specifically from forest roads. The erosion rates and sediment delivery are predicted by the WEPP model, using input values for forest conditions developed by scientists at the Rocky Mountain Research Station (William J. Elliot, Hall, & Scheele, 1999). FS WEPP:Road was used to estimate erosion and sediment yield from selected road segments within the project area. WEPP:Road values reflect road dimensions, design, topography, and proximity to water bodies among other parameters; output is in average annual amount of sediment delivered to streams.

Erosion research conducted in north Idaho by (J. Gravelle, Spinelli, Brede, & Klaus, 2008) and elsewhere by (Lang, Aust, Bolding, McGuire, & Schilling, 2016) found favorable correlation to measured values using FS WEPP:Road from forest haul roads. (Srivastava et al., 2019) found good agreement between measured and WEPP-predicted streamflow and sediment values in a watershed scale experiment. The accuracy of the predicted values from FS WEPP tools are, at best within plus or minus fifty percent. True erosion rates are highly variable due to large variations in local topography, climate, soil properties, and vegetative properties, so predicted values are only a single estimate of a highly variable process (William J. Elliot et al., 1999).

Equivalent Clearcut Area

The ECA calculator was used to depict changes and fluctuations in water yield conditions over time. The ECA method followed the procedures in the USFS Flathead National Forest ECA User Guide (USDA 2012). ECA estimates water yield likely to be delivered to the main channel of a study watershed as modified by forest management and practices within the watershed, including the headwater stream channels. Forest management practices considered are timber harvest, road building, and fires. These estimates include a series of anticipated annual values over a period of years as recovery occurs. The ECA analysis for this project was run as if all project activities would be implemented in 2021. However, it is far more likely that implementation would be spread out over as much as a 15 year period, so the ECA values generated represent a worst case scenario. Some of the key assumptions and limitations of the method are listed below.

- Results do not reflect above average or below average precipitation and associated yield.
- Potential changes in the timing and duration of stream discharge are not predicted.
- The method estimates water yield increases assuming a fully forested condition prior to disturbance across the watershed of interest, which is not realistic due to natural processes such as fire, insects, and disease.
- The shape, size, and aspect of forest disturbances have major influences on snow interception, accumulation, redistribution, and melt. These processes are not captured in the ECA method.

- The method does not account for natural openings such as talus slopes or meadows.
- Hydrologic recovery curves are purely theoretical and they do not account for site specific stand conditions, particularly regeneration.
- Runoff processes are highly complex and the ECA method does not discriminate between saturation overland flow (variable source), infiltration excess overland flow, soil depth, or soil moisture.

The ECA method addresses average conditions and does not consider extreme or rare events, such as high intensity rain storms or rain-on-snow events. Nor does it take into account how the baseline hydrology may have changed due to changes in forest structure and health over the last century. It is a very simple water balance calculator, and relies on average annual precipitation and forest cover to estimate average annual water yield in the form of stream flow. The ECA method is not designed, nor is it used, to develop precise estimates of flow. One utility of the method is that it provides a consistent way to compare alternatives. The values generated by the method may be used, in concert with other water resource information, to interpret the potential effects to stream channels as a result of implementing management activities. Values generated by the method are not to be considered absolute measures against verifiable standards, nor by themselves provide an answer as to the effects of implementing the proposed land management activity. Therefore, the use of models is to provide one set of information to the technical user, who, along with knowledge of the model and its limitations, other models, data, analysis, experience and judgment must integrate all those sources to make the appropriate findings and conclusions.

Field Reviews

Selected roads, segments of the project area streams, and a subset of proposed units within the project area were surveyed during the 2019 field season by the project hydrologist, fisheries biologist and trained hydrologic technicians. Roads were surveyed to assess erosional hazards and risks to aquatic ecosystems and were prioritized where roads were in close proximity to streams and at road/stream crossings. Road surveys included examination of stream crossings and drainage structures. Stream surveys were conducted on segments throughout the project area and focused on the named creeks where concentrations of the project activities are proposed, but also included several unnamed tributaries. Stream surveys were completed in headwater reaches down to lower reaches where the streams leave the project area to get a representative overview of project area streams. All survey information can be found in the hydrology section of the project record.

There were also several field trips with our local collaborative group, the Kootenai Valley Resource Initiative, and several public meetings, where aquatics related issues, such as aquatic organism passage and road stream interactions were reviewed and discussed with members of the public, which added to the project hydrologist’s knowledge of the area. All of the meetings and field trips were advertised in local newspapers and social media and were open to the public.

Incomplete and Unavailable Information

All analysis and modeling is based upon best available data. At this point in time there is no known incomplete or unavailable information. If new information should become available, it would be stated and incorporated into the analysis.

Spatial and Temporal Context for Effects Analysis

Direct/Indirect and Cumulative Effects Boundaries

Direct and indirect effects will be analyzed at the 12-digit Hydrologic Unit Code (6^{th} code) watershed scale because that is where all the proposed ground-disturbing activities would occur. The Westside Restoration project occurs in 6 12-digit watersheds:

- Myrtle Creek
- Snow Creek
- Caribou – Deep Creek
- Burton Creek – Kootenai River
- Fall Creek
- Deep Creek – McArthur Lake

However, the bulk of this project is located within three watersheds, Myrtle Creek, Snow Creek and Caribou – Deep Creek watersheds. The last three watersheds listed above include less than 800 acres of natural fuels burning and minimal road work in each watershed. As discussed in the sediment delivery section of this report, prescribed fires are not expected to be of an intensity that would negatively affect hydrologic processes. Additionally, the maximum of 800 acres of proposed natural fuels burning is a negligible amount of the 16,000 – 20,000 acre watersheds, and all activities would include BMPs and INFS direction, so effects in these watersheds would be negligible and will not be discussed in detail. The temporal boundaries for analyzing the direct and indirect effects are approximately 15 years from present to allow all project related activities such as timber harvest, road work, and tree planting to occur. This timeframe was selected because the probability of erosion decreases several years after disturbance as vegetation recovers (William J. Elliot, 2004)

Cumulative Effects Boundaries

Cumulative effects will also be examined at the same scale as direct and indirect effects. Cumulative effects will be analyzed at this level in order to incorporate other disturbances that may have occurred or are occurring elsewhere in the watershed. Analyzing at the next highest stream level of the Kootenai River would be too large to detect project related effects. Cumulative effects will be considered from present to approximately 2050, which would allow sufficient time for vegetation to recover in terms of hydrologic processes.

Affected Environment

The Westside Restoration project area encompasses approximately 60,000 acres in Boundary County, Idaho and is about 5 miles west of the city of Bonners Ferry, Idaho (see Figure 1). About 85% of the project area is administered by the USDA Forest Service, the remaining 15% is a combination of private timber lands, State of Idaho endowment lands, and lands managed by the US Department of the Interior.

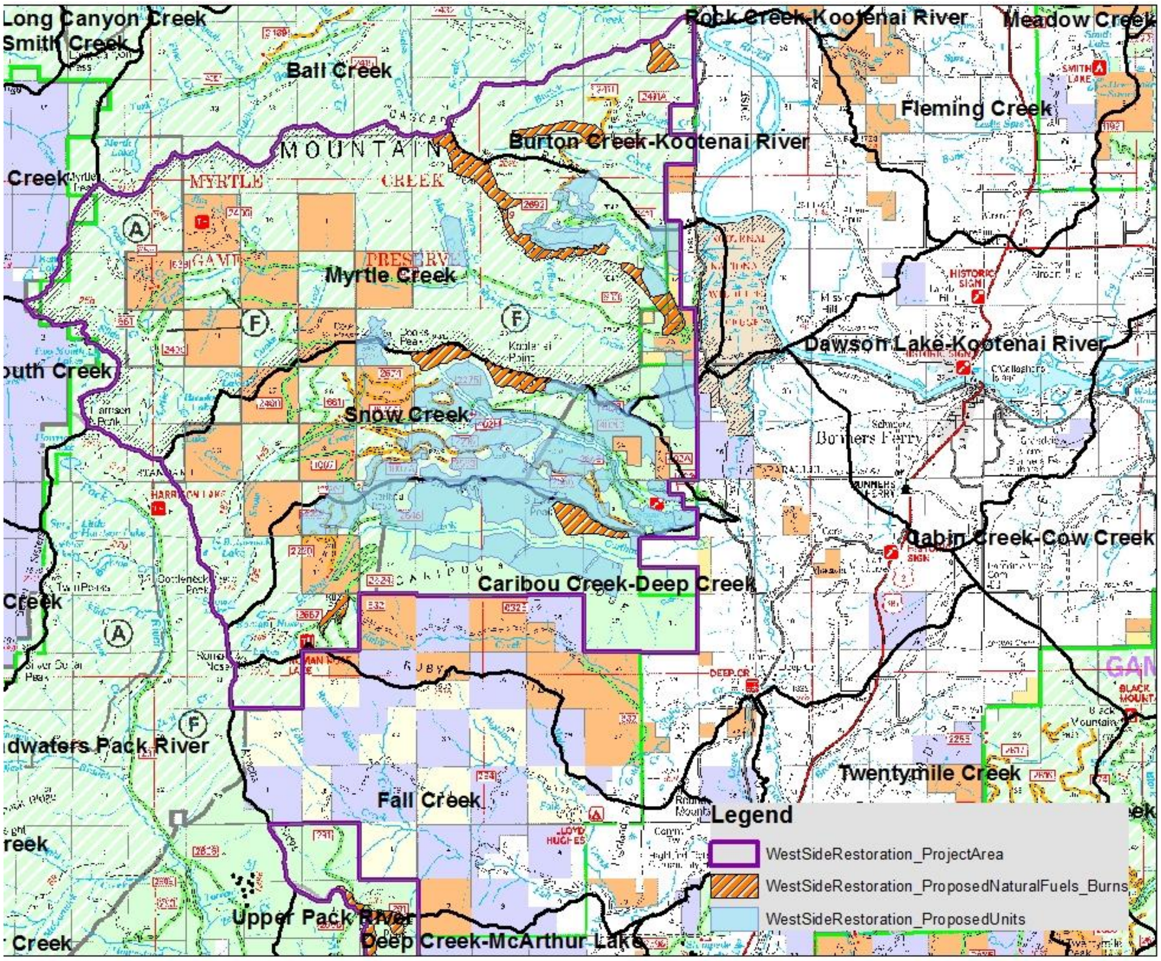

Figure 1. Westside Restoration Project area map. (see EA for map showing updated ownership).

Topography and Climate

Elevations within the project area range from a low of about 1800 feet at the Kootenai National Wildlife refuge to about 7300 feet at Harrison Peak in the headwaters. Slopes range from about 4 to over 75 percent in the project area.

Records from the nearest weather station in Bonners Ferry, ID (located about 11 miles east of the project area) indicates January as the coldest month with average high temperature of 32.3°F and average low of 19°F. July is the warmest month with average high and low temperatures of 83.7°F and 50.1°F respectively. Average annual precipitation is 22.1 inches. The wettest month, on average is December with 3.09 inches and the driest month is August with 0.9 inches of precipitation. Average annual snowfall for Bonners Ferry is 65.4 inches with the most falling in December and January (Western Regional Climate Center 2017).

The climate data described above was collected at an elevation of 1850 feet, which is significantly lower than the project area. PRISM, a precipitation model within the US Forest Service WEPP models adjust precipitation and temperatures based on elevations and topography from established weather station data. The model allows users to input latitude and longitude and the model adjusts the climate for that location.

A location near the center of the project area (48.70º N x 116.53ºE) was selected and input into PRISM which returned results of 4415 feet elevation with an annual average precipitation of approximately 37”. These estimates show how elevation can influence precipitation within the project area. These climate values were used in the WEPP model to estimate erosion rates from the proposed treatment areas. More specifics on climate parameters generated by PRISM can be found in the Hydrology section of the project file.

Soils and Geology

The project area has bedrock geology comprised mostly of metamorphosed granitic intrusion formations of the Kaniksu Batholith. The lower portion of the project area watersheds contain areas of glacial till deposits and glacial lake sediments adjacent to the Kootenai River Valley (IDEQ 2006). The primary soils in the project area are derived from decomposed granite overlain with volcanic ash and can be described as having sandy loam textures.

Wetlands

Numerous wetlands are located adjacent to the eastern boundary of the project area in the Kootenai River Floodplain from searching the National Wetlands Inventory (http://www.fws.gov/wetlands/). Most are located within in the Kootenai National Wildlife Refuge and private lands east of Westside Road. These and all other wetlands that may be located during field reviews or project implementation would receive appropriate protections as described in the project design features.

Beneficial Uses and Water Quality Status

Water quality refers to the physical, chemical, and biological composition of a given water body and how these components affect beneficial uses. The Clean Water Act requires beneficial uses to be protected for each water body in the state. The designated beneficial uses for the streams in the Westside Restoration project area are cold water aquatic life, primary and secondary contact recreation, and salmonid spawning. In addition to those listed above, industrial water supply, wildlife habitats and aesthetics are designated beneficial uses for all water bodies in Idaho.

The 2020 Idaho Integrated Report document was developed by the Idaho Department of Environmental Quality (IDEQ) and approved by the EPA in 2020. Myrtle Creek, Snow Creek, Caribou Creek and Fall Creek are identified as category 4a waters, which indicate a TMDL has been completed.

A total maximum daily load (TMDL) for temperature in Myrtle, Snow, Caribou, and Fall Creeks were approved by the EPA in 2014. The temperature TMDL document identifies the streamside potential natural vegetation (PNV) that provides shade to the creeks, and also identifies where shade may be lacking. Preserving or improving riparian shade and restoring natural channel widths are recommended as the primary activities for implementation of the temperature TMDL.

Snow, Caribou and Fall Creek flow into Deep Creek which also has a TMDL for sediment in addition to temperature which was approved by the EPA in 2007. The sediment TMDL assigns load reduction targets to lands managed by the US Forest Service in order to restore and protect beneficial uses.

Stream Channel Characteristics

Streams in the project area were surveyed between 2016 and 2019 and included segments of Caribou, Snow and Myrtle Creek and some tributaries. Stream surveys documented conditions of streams including characteristics such as channel stability, habitat conditions, fish presence, potential barriers, sediment sources, overstory canopy, quantity of large woody debris, along with other general observations and assessments.

The headwater streams can be typically described as 'A' type channels which are steep (upwards of 12 percent), step-pool systems with gravel and cobble substrate with occasional boulders and frequent pieces of large woody debris (LWD). Finer material consisting of sands and small gravel were found in pools. "A" channels are characterized as entrenched, high energy debris transport systems which are resistant to disturbance when composed of boulder and cobble substrate (Rosgen 1996). Midslope streams were still steep, with gradients ranging from 4-9%, and are also transport reaches with predominantly cobble to boulder sized substrates. There are waterfalls on Caribou, Snow and Myrtle Creeks in the lower reaches which act as an upstream barrier to migratory fish from the Kootenai River. Stream surveys documented good habitat with pools and copious amounts of LWD in these segments. Overstory vegetation was primarily intact with a dense canopy comprised of mainly cedar, hemlock with grand fir and cottonwoods in the lower reaches. The hydrology section of the project file contains more information on stream surveys.

All of the project area streams have a 'moderate' watershed condition rating based on the Idaho Panhandle National Forests (IPNF) watershed characterization spreadsheet. The watershed characterization exercise was completed to assess stream conditions at the 12-digit hydrologic unit level, forest-wide in support of the 2015 Revised Forest Plan. This spreadsheet uses a metric composed of a variety of factors including watershed sensitivity, watershed disturbance and riparian disturbance. The moderate ratings are likely a result of riparian disturbance and road densities from past management activities.

Existing Condition

Water Quality

Sediment Delivery

The Table 2 below displays the results from the FS WEPP Road modeling, showing the total sediment delivered to streams associated with selected road segments that were identified by field surveys to be contributing sediment to the stream network. Research by (Al-Chokhachy et al., 2016) recognized that sediment delivery from locations where forest roads intersect streams (i.e. road crossings) can be particularly acute and comprise a large proportion of sediment production from road networks. Values are in average annual sediment delivered.

Overall there are approximately 5.7 miles of road segments that are producing and delivering sediment to the creeks in the project area. By watershed, Myrtle Creek has 56 road segments totaling 3.1 miles, Snow Creek has 25 road segments totaling 2.2 miles, and Caribou Creek has 9 segments totaling 0.4 miles of road, that are contributing sediment to the stream network. The majority of the sediment being delivered to creeks comes from roads open to public motorized use and the segments adjacent to stream crossings. This is expected as these roads see high motor vehicle use which creates fines that are easily mobilized by runoff, have limited maintenance, and often times located in very close proximity to valley bottom creeks. The restricted motorized use roads have less wear and damage from traffic (i.e. rutting in the wheel tracks) and have a greater vegetative cover across the driving surface which reduces erosion. The sediment values presented in the table below do not include sediment delivery from road failures.

Table 2. FS WEPP Road results of sediment delivery to streams from road segments by watershed.

Watershed	Sediment Delivery (tons/year)	Total length of contributing segments (feet)
Myrtle Creek	6.4	16510
Snow Creek	9.4	11459
Caribou Creek	1.1	2049
Total	**16.9**	**30018**

FS Disturbed WEPP modeling was used to identify upland erosion being delivered to project area creeks. Representative project area hillslopes of units were used in the modeling. The results from the WEPP modeling showed no upland erosion delivering sediment to project area streams from proposed timber harvest units. It is therefore assumed that all current project area sediment delivery is due to road activities.

Water Temperature

Riparian Habitat Conservation Areas (RHCAs) are the areas immediately adjacent to streams. The vegetation within the RHCAs is primarily intact, providing the protective shade to the waterbodies. There are areas that have had timber harvest in the past and are recovering and have not fully reached their maximum shade providing potential. There are also areas where roads encroach on the RHCAs and have reduced shade for the width of the road. Figure B-13 in the Lower Kootenai and Moyie River Potential Natural Vegetation Temperature TMDL (IDEQ 2014) indicates that nearly all of Myrtle, Snow and Caribou Creeks are currently within the target range for the expected amount of riparian vegetation. Overall, stream surveys documented dense, intact forest canopies comprised of expected riparian species, such as western red cedar and hemlock in the project area streams.

Watershed Function

Road Density

There are approximately 200 miles of existing roads in the 93 mi^2 project area. This includes open and restricted motorized routes. Table 3 displays road densities for the project area, including road densities within RHCAs. There are approximately 21.5 miles of roads within the 11 mi^2 of RHCAs within the project area. Roads within RHCAs have the highest probability of delivering sediment to streams. Road densities were calculated by dividing the total road miles by the area of the each watershed. These values include mileages of undetermined roads. Undetermined roads are typically existing roads on the road inventory, but may also include skid trails or other linear features that were added erroneously during aerial photo interpretation. Road densities within the riparian zones were calculated by dividing total road miles within the RHCA by the total area of the RHCAs in that watershed. For context, the average road density for watersheds on the north zone of the Idaho Panhandle National Forest is 2.6 mi/mi^2. Field surveys identified several road segments that are persistent sources of sediment for project area streams and are discussed in the sediment delivery section of this report.

Table 3. Existing Road Densities in the project area watersheds.

Analysis Unit	Total Miles	Road Density (mi/mi²)	Total Miles in RHCAs	Road Density in RHCAs (mi/mi²)
Myrtle Creek	99	2.3	12.5	2.9
Snow Creek	59	2.8	6.1	2.8
Caribou Creek	38	0.8	2.9	2.1

Equivalent Clearcut Area

The baseline ECA value for the project area watersheds was obtained from the Watershed Characterization that was conducted for the IPNF Forest Plan revision in 2015 and updated to include more recent timber harvest that has been completed. Background data of past harvest, fires, and road construction was used in the analysis. Some past harvest values were estimated for Caribou Creek – Deep Creek because about 68% of the watershed is other ownership. The current ECA values for the project area watersheds are shown in Table 4 below.

Table 4. Existing ECA values for the project area watersheds.

Watershed	ECA Acres	Percent ECA
Myrtle Cr	3137	11%
Snow Cr	1265	9%
Caribou Cr	2416	8%

Environmental Consequences

Alternative 1 – No Action

Under the no action alternative, none of the timber harvest operations, reforestation, landscape burning, priority road maintenance or reconstruction, road construction, road decommissioning or other project activities associated with the action alternative would take place. Regularly scheduled road maintenance would continue to occur on the existing road network.

Direct and Indirect Effects to Water Quality

Sediment Delivery

Sediment contributions from roads would remain unchanged from the existing condition. Road maintenance would occur as normal and would be beneficial, but the normal intensity of maintenance may not provide the same degree of improvements as proposed with reconstruction, to reduce the risk of road failures. Therefore, the lack of road improvements commensurate with the current level of road conditions in the project area could perpetuate sediment delivery from surface erosion and increasing risk of culvert failures.

Delaying harvest in overstocked timber stands could result in an increase in tree mortality and fuel build-up. Continued fuel loading would increase the risk of high intensity wildfires that could kill most of the vegetation in both upland and riparian areas. (Spigel & Robichaud, 2007) reported maximum erosion rates exceeding 32 tons/acre after high intensity fire on steep slopes in west-central Montana, depending on fire intensity, terrain, and climate. Increased runoff combined with a lack of vegetative cover to protect soils following a fire would lead to increased peak stream flows, excessive sediment delivery and consequent adverse impacts to water quality and aquatic habitat. The risk of debris flows immediately after a fire increases as a result of soil impacts coupled with increased potential for surface runoff. Debris flows can be the most damaging in the short-term to stream networks by the quantity of sediment that can be delivered. Impacts to soil erosion from these disturbances typically last a few years before rapid revegetation covers the surface with protective plant litter (William J. Elliot, 2004), (Ryan & Dwire, 2012). Increased risk of road failures as a result of debris flows and an increase in erosion and sediment delivery could be expected from the existing the road network as a result of fire. Research conducted after a wildfire in Colorado found that road surface erosion rates increased with hillslope burn severity (Pérez, 2016).

These negative effects of fire were realized locally in Myrtle Creek in 2003 when about 3000 acres burned. Myrtle Creek is the municipal water source of the city of Bonners Ferry and the fire negatively impacted the water plant operations due to excessive sediment and ash loading for several years after the fire. There was also damage to Forest Service roads due to debris flows that initiated within the fire perimeter, overwhelmed culverts with debris and then overtopped the road which washed away portions of the fill. The most recent of these events occurred in 2012, which was nine years after the fire. While wildfires are a natural watershed process, there can be negative results for values within a municipal watershed.

Water Temperature

Alternative 1 would not include timber harvest, fuel treatments or road decommissioning, storage or reconstruction; thus no new direct or indirect effects to project area floodplains would occur. Through natural recovery, plant vigor and composition in the riparian zones would be expected to increase and contribute more shade as these areas recover from past treatments. The rate of progression and anticipated temperature changes would be slow and vary in time depending on the existing condition of the watershed including soils, vegetation, continuing activities, and intensity of past activities.

Direct and Indirect Effects to Watershed Function

Road Density

Project area road densities would remain unchanged because no new roads would be constructed and no roads would be stored or decommissioned.

Equivalent Clearcut Area

Under the no action alternative, ECA would be the same as described for the existing condition and would decrease as past harvest units throughout the watersheds continue to recover. There would be no new management activities that would affect ECA. However, delaying harvest in overstocked timber stands could result in an increase in tree mortality and fuel build-up. Continued fuel loading would increase the risk of high intensity wildfires that could kill most of the vegetation in both upland and riparian areas, thus increasing the ECA. For example, about half of Myrtle, Snow and Caribou Creeks burned in 1889 and 1926, which may have equated to ECA values above 50%, with corresponding increases in streamflow and peak flows.

Although the no action alternative would not increase ECA values, some research conducted on the Priest River Experimental Forest, located about 26 miles southwest of the project area, concluded that annual water yield has increased an average of 33% over the 73 year period of record for the 950 acre Benton Creek watershed (Tinkham, Denner, & Graham). The authors surmised the increase in annual streamflow may be the result of a gradual change in forest tree species or forest conditions because the gaged watershed has not seen significant timber harvest or fires that would have increased the ECA values and precipitation has remained constant. This research indicates that there may be increasing streamflow values in some of our forested watersheds regardless if ECA values remain low.

Alternative 2

A full description of Alternative 2 is provided in the Westside Restoration EA.

Project Design Features

The Forest Service has the statutory authority to regulate, permit, and enforce land use activities on its lands that affect water quality and is responsible for implementing nonpoint source pollution controls and meet Idaho Water Quality Standards. To comply with State Water Quality Standards, the Forest Service is required to apply water quality practices in State Forest Practices Regulations, where applicable, reasonable land, soil, and water conservation practices, or site-specific BMPs. These practices are designed with consideration of geology, land type, soil type, erosion hazard, climate, cumulative effects, and other factors in order to protect and maintain soil, water, and water-related beneficial uses, and to prevent or reduce nonpoint source pollution.

The Westside Restoration project EA contains a full list of project design features to protect aquatic resources.

Estimated Effectiveness – High. The 2020 Idaho Interagency Forest Practices Water quality Audit (IDEQ 2020) describes how the erosion control measures observed in the state-wide audit are generally effective when properly installed and maintained. This audit also acknowledged the Forest Service had 96% compliance during the last 4-year audit cycle and averaged 98 percent compliance with BMP rules since 2000. The same audit also found slash mats were the most practical method for controlling erosion from skid trails, and road measures, such as gravelling, rocking ditches, installing rolling dips and waterbars were effective at reducing erosion. This is corroborated by the FS WEPP:Road erosion modeling results, the literature review of research on BMPs conducted by (Edwards, Wood, & Quinlivan, 2016), (Sugden, 2018) and also by local monitoring.

Direct and Indirect Effects to Water Quality - Alternative 2

Sediment Delivery

Effects to Sediment from Road Reconstruction and Maintenance

Alternative 2 proposes about 76 miles of road maintenance or reconstruction. This would consist of brushing, blading, gravel additions to the driving surface, and drainage improvements. Road maintenance would improve drainage by replacing, upgrading, or installing new culverts, and/or cleaning and armoring ditches where necessary. Please refer to design criteria section of the Environmental Assessment for specifics. Numerous opportunities to reduce sediment delivery from roads in the project area were identified during road surveys, primarily at stream crossings of open roads. Priority road maintenance would occur at these crossings and would include work such as installing a combination of ditch relief culverts or drivable dips before each perennial stream crossing and graveling the driving surface over the crossings. Gravel surfacing reduces erosion of the driving surface and installing ditch relief culverts or rolling dips before stream crossings disconnects the ditch from the stream and allows sediment to filter out across the forest floor. Priority road maintenance consists of typical road maintenance practices, but is located specifically to reduce negative road/stream interactions as identified through road surveys and subsequent erosion modeling results from FS WEPP:Road. Recent research by (Sugden, 2018) found that this type of road work completed in Montana and north Idaho, which he calls ‘key BMPs’ was effective at reducing sediment delivery by an average of 46%.

Table 5. Sediment delivery by watershed and length of contributing road segments that would receive priority road maintenance.

Analysis Unit	Existing Sediment Delivery (tons/year)	Alt. 2 Sediment Delivery (tons/year)	Sediment Reduction (tons/year)	Total length of contributing segments (miles)
Myrtle Creek	6.4	1.1	5.3	3.1
Snow Creek	9.4	1.3	8.1	2.2
Caribou Creek	1.1	0.3	0.8	0.4

Table 5 displays the FS WEPP: Road estimated sediment delivery reductions after priority road maintenance activities. FS WEPP:Road considers traffic levels so predicted sediment delivery values reflect high traffic conditions, which would describe traffic levels associated with the timber harvest operation. BMPs will be incorporated into all road work since they have been shown to be protective of water quality and beneficial uses (Seyedbagheri, 1996), IDEQ 2020, (Edwards et al., 2016).

Some road reconstruction and maintenance activities, such as blading and ditch clearing, can increase the susceptibility of erosion on the road and ditch surface for a short time (days to weeks) after the work by making fine particles more available to movement. This increase can be mitigated by employing BMPs such as timing road blading to when soil moisture conditions are appropriate, or applying water with a tanker truck while grading during the dry season. Other BMPs that would be effective reducing sediment delivery in the short term are mulching and seeding, and using a roller to compact the surface after blading. Regardless, the long term benefits of improving drainage and armoring road surfaces would outweigh any short term increases as a result of maintenance and reconstruction activities.

Effects to Sediment from Road Storage and Decommissioning

Alternative 2 proposes to store about 11 miles of system road; 5 miles that is currently open, 6 miles which are seasonally restricted, and about 3 miles of roads currently stored which would be reconstructed, used for the project, and placed back into storage following implementation. Alternative 2 also proposes to decommission about 1.5 miles of roads. The roads proposed for storage and decommissioning are listed in the EA. The roads proposed for storage and decommissioning were not modeled with FS WEPP because of their current heavily vegetated condition and lack of active erosion process documented during field reviews. Research conducted on the IPNF indicates that thick duff, vegetation, and moss layers found on brushed-in roads protects the surface from erosion (R. B. Foltz, Copeland, & Elliot, 2009). Since active sediment contributions are low from these segments, benefit would primarily be realized in the form of reduced risk of sediment delivery from culvert failure due to insufficient capacity or blockage. Storage would remove high risk drainage structures and install additional drainage at frequent intervals, such as waterbars and relief swales, to render the road stable and hydrologically inert. Stored roads should need no maintenance when in storage but remain on the FS inventory for possible future and emergency use. Culvert removals could be accomplished with machinery or by using explosives. There would be short-term increases in sediment and turbidity during removal of culverts. A 2007 study of culvert removals reports an average sediment delivery amount of about 150 pounds; however this amount can be reduced to about 4 pounds using appropriate BMPs (Randy B. Foltz, Yanosek, & Brown, 2007).

Field review of the undetermined roads in the project area documented heavily vegetated, hydrologically inert conditions. Although sediment contributions are low, compacted driving surfaces left on the landscape can still increase runoff and disrupt hydrologic continuity. The same study by Foltz et al. (2009), also discloses that hydraulic conductivity of brushed-in roads does recover towards values found on undisturbed forest floors, but many decades of recovery may be needed. Field review of these roads indicates they are stable, heavily vegetated and lack ditches and drainage structures that are the primary cause of mass failures and disrupted watershed function. These roads would remain stabilized and revegetated since traffic has been excluded for several decades already, extensive vegetation is established, and the road designs are resistant to failures.

Effects to Sediment from Recreation Improvements

Recreation improvements would consist of construction of new non-motorized trail, improving trail and trailhead drainage, expanding trailhead parking areas, building two new trailhead parking areas along the Snow Creek road, and relocating problem trail segments. The project also proposes to construct a warming hut near Roman Nose campground. Further, several eroded segments of trail would be rerouted to more suitable locations with lesser grades and away from streams which would reduce erosion potential. The old segments of trail would then be closed and rehabilitated. These improvements would provide an overall improvement to hydrologic resources.

Expanding the parking areas at the Bottleneck Lake, Snow Creek Falls and Roman Nose trailheads are located far enough from streams that no sediment delivery is expected. The expanded parking at these locations would provide a slight benefit, especially at Roman Nose, where the designated parking would better accommodate the increased use of this area where motorists are currently parking their vehicles in an unorganized manner which is widening the road. Further, several dispersed campsites that are located in undesirable places would be removed and rehabilitated.

Construction of the snowmobile parking areas in the Snow Creek watershed would be expected to increase sediment delivery by about 160 pounds per year from the compacted surface assuming each parking area is ½ acre in size. This estimate was obtained using FS WEPP and assumes an RHCA width of 150 feet. Sediment delivery estimates would be less if the parking areas are located further away from streams. The parking areas would be located as far from streams as possible and would include design features to minimize erosion potential.

Construction of the new non-motorized trail is not expected to increase sediment delivery over the existing condition. New trail construction would be located away from streams, include BMPs and be designed to control drainage so that water does not concentrate and flow down the trail for long distances. This would be accomplished by building the trail with grade reversals and other drainage features at regular intervals, especially near any stream crossings and would be included as design features. Further, these non-motorized trails would be narrow, about two feet wide or less and would minimize sections with steep gradients and would be located primarily along ridgelines.

Construction of the snowmobile warming hut would not be expected to increase sediment delivery. The hut would be located away from streams and lakes on a ridge top near the Roman Nose Campground. BMPs such as seeding and mulching would be included to minimize erosion from the site during construction. Though there is limited supporting evidence, one slight benefit that may occur if the warming hut were constructed is it may draw human use away from the frozen lake surface during the winter months as this is a popular snowmobiling area. If the hut were maintained with regular trash removal, it may reduce the amount of litter entering the lake when the ice melts in the spring.

The only activities proposed that would occur within the Ball Creek watershed is about one mile of road to trail conversion. The last mile of FSR 432 is proposed to be stored and a non-motorized trail left on the driving surface. This would provide a slight benefit to aquatic resources in Ball Creek because the current road would be stabilized and have more of the driving surface decompacted and revegetated than the existing condition which would reduce the erosion and sediment delivery potential.

Effects to Sediment from Temporary Road Construction

Alternative 2 would increase the risk of negative consequences of road/water interactions, such as sediment delivery and the possibility of culvert failures, with the construction of approximately 28 miles of temporary roads. It should be noted that about 1/3 of the proposed temporary road mileage would be constructed on an existing prism of an undetermined road. All temporary roads that are built are proposed to be decommissioned and stabilized by a combination of activities such as decompacting the driving surface, full or partial recontouring with all drainage structures removed. Temporary roads would have a design feature that would limit the amount of time the roads would be on the landscape to a maximum of 5 years after they are constructed. A combination of field review and GIS analysis was used to estimate how many segments of proposed new road would contribute to the stream network. This process identified 11 stream crossings total. Only about 1100 feet of the proposed 28 miles would be located close enough to waterbodies to deliver sediment, the rest of the proposed temp roads are located away from steams on suitable terrain. A review of research in Idaho and elsewhere concluded that non-channelized runoff from roads has a low probability of traveling further than 300 feet (Belt. et al. 1992). Table 6 below shows how the stream crossings and adjacent contributing segments are distributed through the project area watersheds and FS WEPP:Road sediment delivery results. The temporary roads would contribute less than 0.1 tons/year in the project area watersheds as long as the temporary roads are maintained in an open, drivable condition, which is anticipated to be 5 years to complete project activities. The FS WEPP:Road sediment delivery estimates shown in the table below assume that the new construction would include the design features, namely limiting road grades on the approaches to streams and installing ditch relief culverts or rolling dips to limit the length of road that contributes to the stream crossing.

Table 6. Sediment delivery estimates from proposed temporary road construction.

Analysis Unit	Number of stream crossings	Sediment Delivery at each crossing (lbs./year)	Total Sediment delivery (tons/year)	Total length of contributing segments (feet)
Myrtle Creek	3	50	+0.1	300
Snow Creek	4	50	+0.1	400
Caribou Creek	4	50	+0.1	400

The risk of road failures and subsequent sediment delivery would also be elevated during the period that the temporary roads are maintained in a drivable condition. Sediment delivery as a result of road failures are not included in the FS WEPP results. Sediment delivery and risk of failures would be expected to return to near zero when the roads are decommissioned and stabilized upon project completion.

Effects to Sediment from Vegetation Prescriptions

Disturbed WEPP was used to estimate sediment delivery from proposed timber harvest and burning prescriptions for Alternative 2. Modeling results indicate the proposed action would not increase sediment delivery over existing conditions. Units with proposed pre-commercial thinning prescriptions were not modeled because they would likely be completed by hand sawing and would have negligible ground disturbance. Also, if machinery such as a masticator were to be used, there would be minimal ground disturbance due to the copious amount of slash and plant material acting as ground cover. All modeling information can be found in the Hydrology section of the project file.

Timber harvest prescriptions include design features and BMPs to minimize soil disturbance. The Westside Restoration EA includes a detailed list of design features and BMPs such as timing restrictions to ensure project activities only occur when soils are not saturated. Potentially sensitive areas, including areas near known past mass failures, were excluded from units during project preparation and layout phase. Units that would be skyline logged create minimal ground disturbance. Ground skidding would be completed using measures such as slash mats and designated skid trail locations to reduce compaction. Since all timber harvest would include design features to protect soil and water, sediment delivery from these units would be so slight as to not be measurable. Research studies and monitoring results conducted on the IPNF verify that when riparian buffers are incorporated into timber sales, sediment delivery to stream channels is not measurable or is negligible. (IDEQ 2020).

Effects to Sediment from Landscape Burning

Alternative 2 proposes about 2500 acres of burn only units. A negligible increase in sediment yield to streams would be expected from the burn only units. The surface condition after a prescribed fire is typically a mosaic-like pattern of low severity, high severity, and unburned patches (Robichaud, Beyers, & Neary, 2000). The patterns of burn severity help control the spatial scale at which the effects of prescribed burning can be detected (Troendle et al.) in (William J. Elliot, Miller, & Audin, 2010). The patchiness of burn severity allows unburned and low severity patches to infiltrate runoff and trap sediment that is generated on adjacent high severity patches (Biswell & Schultz, 1957); (Cooper, 1961); (Swift, Elliott, Ottmar, & Vihnanek, 1993). This project would include design criteria which excludes ignition within RHCAs. This would limit the fire severity and subsequent consumption of litter and surface roughness which traps sediment before it is delivered to the stream. Fire would be allowed to back into RHCAs but the intensity would be expected to diminish due to the increased shade, humidity, and fuel moistures found in riparian areas; and would be expected to have generally beneficial results. (Dwire & Kauffman, 2003) reported that prescribed fire may remove aboveground biomass from certain riparian trees and shrubs but is unlikely to negatively affect belowground structure. This indicates the bank-stabilizing properties of the riparian vegetation is preserved and the trees, shrubs and forbs would recover quickly. The prescribed fires would have specific criteria to limit the severity of the fires included in the burn plans such as; constraints on fuel, duff, and soil moistures, weather conditions such as relative humidity, areas to exclude ignition, etc. Fire intensity would be further controlled and adjusted during implementation by modifying the patterns of ignition. Additionally, burns would likely be initiated a short time before wet weather is expected. The burn only units would be completed in parts over a time span as long as 15 years, as favorable burning conditions occur.

Sediment Delivery Summary and Discussion

Table 7. FS WEPP Sediment Delivery Estimates (average annual tons/year) for alternative 2. Values are calculated as the difference from the existing condition.

Analysis Unit	Road Maintenance and Reconstruction	Road Storage and Decommissioning	Recreation Improvements	Temp Road Construction and Reopening Roads	Timber Harvest and Landscape Burning	Total
Myrtle Creek	-5.4	-0	-0	+0.1	+0	**-5.3**
Snow Creek	-8.3	-0	+0.1	+0.1	+0	**-8.1**
Caribou	-0.9	-0	-0	+0.1	+0	**-0.8**

Table 7 summarizes the sediment delivery values of the proposed activities. The project area watersheds would see a reduction in sediment delivery of 5.3, 8.1, and 0.8 tons per year from Myrtle, Snow and Caribou Creek respectively. The bulk of the reductions would be realized from priority road maintenance activities that were identified during field review of the existing road network and would provide long term reductions from the existing road network. Temporary road construction and reopening roads would increase sediment delivery in the project area watersheds about 0.1 tons per year during the project implementation phase, expected to last about 15 years. Sediment delivery reductions from the priority road maintenance activities on the existing road network would far outweigh the anticipated increases from the temporary road construction, reopening roads and recreation improvements.

Sediment delivery as a result of road failures is not included in the FS WEPP results, and the probability of this occurring during the implementation phase would be increased while additional temporary roads are on the landscape.

To put these sediment values in context, table F-1 on page 193 of the Kootenai and Moyie River Subbasin Assessment and Total Maximum Daily Loads document (IDEQ 2006) identifies that the natural background sediment delivery value for forested watersheds is 0.03 tons/acre/year in the Deep Creek watershed, which is adjacent to the project area and is the receiving watershed of Caribou Creek. So, for example, the 30,798 acre Caribou - Deep Creek watershed has a baseline sediment budget of 924 tons per year. Sediment reductions from priority road work in the tens-of-tons range would be meaningful proportion of the hundreds-of-tons background rate, where the fractions-of-tons increases from road construction and road reopening activities is a small percentage of the overall background watershed sediment rates.

Water Temperature

Direct incoming solar radiation is the dominant energy input for increasing stream temperatures with shade being the single most important variable to reduce this heat input (Cobb, 1988),(J. A. Gravelle & Link, 2007), (Krauskopf et al., 2010). Of the proposed actions, timber harvest and to a lesser degree, landscape burning are the activities that could potentially increase the amount of solar radiation reaching the streams. The proposed temporary road construction would remove vegetative cover at the estimated 11 stream crossings on the stream network. This amount of canopy removal would be considered negligible, because the width of the canopy removal to accommodate the road would be about 30 feet at each crossing, compared to the many miles of RHCAs in the project area. Through the implementation of the INFS (USDA 1995) and the incorporation of RHCAs into the proposed action, the proposed activities would not further degrade water quality with respect to temperature because RHCAs would retain the canopy cover that prevents solar inputs to the stream. Field reviews of project area streams documented dense, intact overstory and understory vegetation providing canopy cover.

Direct and Indirect Effects to Watershed Function - Alternative 2

Road Density

Table 8. Road density and Road densities within RHCAs by alternative before, during, and after project completion.

		Watershed Road Density (mi/mi²)			Road Density Within RHCAs (mi/mi²)		
Analysis Unit	Area (mi²)	Existing	Implementation Phase	Post-Project	Existing	Implementation Phase	Post-Project
Myrtle Creek	43.1	2.3	2.3	2.1	2.9	2.9	2.8
Snow Creek	21.2	2.8	3.3	2.5	2.8	2.8	2.5
Caribou Creek	48.1	0.8	0.9	0.9	2.1	2.2	1.8

Table 8 shows road density values before, during and after proposed project activities in the project area watersheds. Effective road densities within the project area watersheds would see minimal change from the existing condition after all the project related activities are complete. There would be a slight reduction due to the 11 miles of open road that would be stored upon project completion. However, road densities would increase during the implementation phase of the project when 28 miles of temporary roads are constructed to accommodate project activities. These mileages represent total values and would not be implemented all at the same time. Road density increases would be limited to some extent by design features, which control how many miles of road are reopened or constructed at any one time before others are returned to a stored condition. Project activities are expected to occur over a 15 year time frame.

Increased road densities during project implementation would have several negative effects to watershed function; increased probability of modifying flows because of the network of ditches and culverts that collect and concentrate flows, increased likelihood of contributing sediment into stream networks as discussed in the sediment delivery section, and increased probability of road failures, such as when culverts plug and divert water down the driving surface. Predicting when and where road failures may occur is impossible because they are typically the result of extreme weather events, so the effects are best described in qualitative terms.

Project design features would be expected to limit negative effects from the increase in road densities during project implementation. The re-opening of non-system roads and construction of temporary roads would be limited so that all the miles of temporary and re-opened road are not present on the landscape at any one time. Temporary roads would be decommissioned and stabilized within 5 years of construction.

Although the potential for road failures increases with road density during the project implementation phase, the potential for sediment delivery as a result is not expected to exceed the sediment reductions achieved from priority road maintenance activities because the reductions would occur year after year.

When roads are put into storage, their impact on watershed function would be minimal, and are no longer considered part of the road density calculations. Stored roads would be stabilized and have a low probability of failure when in storage, but the risk would not be eliminated. Storage prescriptions would require the installation of frequent drainage, such as waterbars, that would drain ditches regularly and distribute water across the hillslope instead of concentrating and conveying water to wider-spaced ditch relief culverts. Stream crossing culverts would be removed and the adjacent road prism stabilized to prevent failures. Mulching and seeding would hasten vegetative recovery. Stored roads would have vehicles excluded which reduces the probably of rutting and other road damage and would not inhibit vegetative recovery. Stored roads remain on the inventory for future or emergency use.

Equivalent Clearcut Area

The ECA values for the proposed action is presented in Table 10 below. Alternative 2 would raise ECA values in all three project watersheds.

Table 9. Equivalent Clearcut Area values for the proposed action.

Analysis Unit	Watershed Area (acres)	Existing ECA acres and %	Proposed Action ECA acres and %
Myrtle Creek	27573	3137 (11%)	3343 (12%)
Snow Creek*	13538	1265 (9%)	2612 (19%)
Caribou Creek	30798	2416 (8%)	3588(12%)

(* Timber harvest activities in the Snow Creek watershed would include a design feature that would limit timber harvest in this watershed to less than 1800 acres within any consecutive 5-year period. This design feature would limit the ECA values below 20% within the Snow Creek watershed for the life of the project by maximizing vegetative recovery between harvest activities.)

Increases in peak flow as a result of the proposed action would probably not be detectable in the main Myrtle Creek, Snow Creek or Caribou Creek channels and could not be differentiated from normal climatic fluctuations. Additionally, ECA values displayed in Table 9 represent conditions if all timber harvest and landscape burning activities occurred simultaneously in 2020 (half of the proposed units in Snow Creek in 2020). In practice, these activities would occur over a period of at least 15 years which would further reduce the ECA values. (Grant et al., 2008) concluded from a comprehensive literature review that ECA under 20% will not have a detectible influence on water yield or peak flows that can be measured beyond natural variability. The Westside Restoration Project would have no detectible influence on water yield or peak flows in the project area watersheds.

Field review of stream channels identified steep stream channels that are comprised of boulder to gravel substrate with adequate large woody debris which provide stability to stream channels.

Other project design criteria, such as priority road maintenance that would occur on the existing road network and would improve drainage and make the roads more resilient to flood effects.

The proposed action would result in several openings larger than 500 acres as a result of timber harvest and while the ECA method does not consider orientation or the size of individual openings, the total area of openings is considered for each watershed in the ECA calculations presented. Creating larger openings could have a benefit to ECA values in the event of a fire. The Westside Restoration Fire and Fuels report describes how larger proposed vegetation treatments areas can better reduce fire behavior and severity of a fire.

For historical context, alternative 2 would be within the historic range of variability when comparing the difference in the increase of ECA from the existing condition. During the 1889 and 1926 fires, ECA may have climbed from zero to over 50 percent, which according to (Grant et al., 2008) would have increased peak flows 15 to 30%. It is estimated that hydrologic recovery gradually occurs over 20-30 years. Hydrologic recovery occurs when conifer growth becomes mature enough to return transpiration, and canopy processes (snowfall interception, shade, etc.) to pre-disturbance values. Paired watershed studies suggest that any increase in annual water yields resulting from clearcutting will drop to zero within 30 years, and there may then be a period of a net decrease in water yields as a result of the active regrowth and changes in species composition (Jones & Post, 2004).

Some research indicates that water yield increases (and associated effects on streams) may not be as important as previously thought, especially in the context of contemporary forest management that uses protective measures from the Inland Native Fish Strategy, best management practices, and other regulatory direction discussed previously. Issues commonly raised by the public include how changes in water yield may directly or indirectly affect stream channels, aquatic habitat, and water quality. Numerous studies have documented the effects of forest canopy removal on water yield, but surprisingly, very few have demonstrated a direct link between water yield changes and channel impacts in a forested environment. For example, (Grant et al., 2008) conducted a comprehensive literature review and determined no field studies have made a direct link between peak flow increases and channel impacts. The same research concluded that the effects of peak flow increases are relatively minor in comparison to other human-caused changes to streams and watersheds. Management-induced increases in peak flow diminish with the percentage of watershed impacted and increasing recurrence interval. This means there is no conclusive evidence that forest management activities further compound effects from large flood events (events larger than what would occur once every 6 years on average). Management effects on peak flow events over a 6-year recurrence interval are highly speculative. (Grant et al., 2008) (Schnackenberg & MacDonald, 1998) found no correlation between ECA and stream channel characteristics in forested catchments in Colorado. (MacDonald & Hoffman, 1995) studied the relationship between WATSED-predicted water yield/peak flow increases and channel characteristics on the neighboring Kootenai National Forest. None of the channel types (pool riffle or step-pool) showed any increase in bankfull width or width-to-depth ratio with more intensive management. However, there were correlations between management indices and sediment characteristics, which suggest that sediment delivery is a more important consideration than water yield.

New research also highlights the complex relationships that exist in forestland hydrology, from a broad-scale perspective. Several recent studies found declining streamflows in watersheds across the Northwestern United States, where the analysis included several stations that are located within the Idaho Panhandle National Forest (Clark, 2010) and (Luce, Abatzoglou, & Holden, 2013). (Bearup, Maxwell, Clow, & McCray, 2014) found a 30% increase in streamflow in Rocky Mountain watersheds after a significant portion of the forested watershed was killed by beetle infestations, while (Biederman et al., 2015), working in similar watersheds, found no change in streamflows after a similar loss of canopy due to beetle killed forests. As mentioned earlier in this report, (Tinkham et al.) reported a 33% increase in annual streamflow over the 73-year period of record on a small, minimally managed watershed located near the project area, and attributed the increase to a gradual change in forest composition. Overall, these studies perhaps provide some insight into the complexity of predicting changes to forest hydrology after disturbances and provide context to any potential increase in peak flows (within a certain return interval) as a result of project activities where baseline streamflows may be declining incrementally across the western United States.

Changes in forest vegetation resulting from management or natural events can affect the frequency and magnitude of rain-on-snow events (Harr, 1986). GIS analysis shows that 27% to 39% of the cumulative effects area watersheds fall within the rain-on-snow zone. This is an elevation zone between 3000 and 4500 feet where the snow pack generally accumulates all winter long but is constantly near 0º Celsius. If a warm, moist air mass arrives and raises the freezing level above 4500 feet, rain falling on the snowpack below the freezing level can lead to rapid snowmelt and a large runoff event. Floods are natural events and occur even when the watershed has a relatively low ECA. The greatest impacts observed from rain on snow events are not from the flood event itself, but occur when roads encroach floodplains or culverts become plugged from resulting floods and debris flows and cause damage to infrastructure such as roads. These events do not occur on an annual basis; and they are dependent on certain climatic conditions such as air temperature, intensity and duration of precipitation, rain-on-snow elevations, and snowpack characteristics (Berris & Harr, 1987). As discussed above, (Grant et al., 2008) found no conclusive evidence that forest management activities further compound effects from large flood events (events larger than what would occur once every 6 years on average) and that management effects on peak flow events over a 6 year recurrence interval are highly speculative. In summary, rain-on-snow and resulting peak flows are natural processes in this area and are responsible for the overall morphology and stability of stream channels in the area.

Cumulative Effects

Past, Present, and Reasonably Foreseeable Activities Relevant to Cumulative Effects Analysis

The following is a description of past, present and reasonably foreseeable actions that establish the appropriate geographic and temporal boundaries for the cumulative effects analysis. Activities identified below were considered relevant to the watershed cumulative effects analysis. Other activities listed in the Westside Restoration EA (e.g. tree planting, firewood gathering, etc.) are not discussed here because there are no measurable soil or watershed disturbance anticipated by these activities.

Past Activities and Events

Wildfires, timber harvesting, homestead, and road construction activities have occurred throughout the watershed. More information on historic timber harvesting can be found in the vegetation section of the Westside Restoration EA. These activities and their effects were analyzed using the ECA and FS WEPP models and incorporated into the current baseline condition, and to look at historic ranges of variability for the project area watersheds. This is discussed in the Affected Environment section of this document.

Mining activities have occurred throughout the project area. Most are small exploratory diggings that were not extensively developed, and most occurred over 50 years ago and have recovered in terms of ground cover, which protects soils from erosion.

Present, Ongoing and Reasonably Foreseeable Activities

Fire suppression activities over the last century within the project area have allowed, and would continue to allow, untreated stands to progress toward climax vegetation conditions. The current trend is toward increasing stand densities, which makes them more susceptible to insects, disease and risk of fires (Vegetation and Fire and Fuels sections). Since changes in water yield are associated with vegetation conditions, the existing and future trends would have an effect on water yield.

General motor vehicle, off road vehicle, and snowmobile use on roads and trails. Motorcycles, ATVs and snowmobile use of the area may increase as motorized recreation popularity increases. Increased traffic and a lack of road or trail maintenance can cause an increase in erosion and sediment delivery.

Road and trail maintenance activities occur annually to some degree within the watershed. These activities include, but are not limited to, blading, brushing, and ditch/culvert cleaning. Maintenance typically improves drainage and decreases erosion from water channeling down the road surface. Culvert and ditch clearing lowers the risk of failures.

The North Zone Roadside Salvage project has road segments located in the project area. This project proposes to remove hazard trees and blow down along selected open Forest Service roads. This project is not expected to cause additional effects to aquatic resources because of minimal increase of canopy openings, INFS criteria would be expected to be met, and no equipment would leave the road surface. There are no North Zone Roadside Salvage units currently planned within the project area watersheds.

Timber Stand Improvement – This activity (pruning, thinning, etc.) would occur outside RHCAs except where it could potentially improve riparian habitat. No ground disturbance would occur and timing restrictions would be enacted. No detrimental direct or indirect effects to watershed and fisheries are expected to occur.

Activities on other ownership- There are about 13 square miles of private lands, comprised of private timberlands, within the project area boundary with most located within the Myrtle and Snow Creek watersheds. There are several thousand acres of private lands in the lower reaches of the Caribou Creek watershed cumulative effects area. Private land makes up 21%, 25%, and 68% of the watershed area for Myrtle Creek, Snow Creek, and Caribou Creek watersheds respectively. The value for the Caribou Creek watershed is higher because the boundary includes areas south of Caribou Creek in the Ruby Creek watershed that is a separate drainage where no project activities would occur. The private lands are comprised of homesteads, timber lands, ranches, and agricultural areas. The lower reach of Myrtle Creek also has the Kootenai Wildlife Refuge that manages wetlands for wildlife habitat. The Idaho Dept. of Lands has reported there are about 111, 221, and 403 acres of future timber harvest anticipated in the Myrtle, Snow and Caribou Creek watersheds, respectively.

Boundary County replaced the bridges over Snow Creek and Caribou Creek on Lions Den road in about 2016. The new structures are located downstream the project area and the new bridges are larger and have increased the capacity for flow at these locations.

Cumulative effects to Water Quality for Alternative 2

Sediment Delivery

The combination of direct and indirect effects of all alternatives with past, present and reasonably foreseeable activities within the cumulative effects area would result in an overall net decrease in sediment yield to the project area watersheds upon project completion. As described in table 8, project area watersheds would have a net reduction in sediment ranging between 0.8 to 8.1 tons per year (average annual amounts). These reductions are realized primarily by the proposed priority road maintenance activities. The stream crossing culvert upgrades, road storage and decommissioning treatments would also reduce the risk of sediment delivery due to road failures but this amount is not included in the sediment modeling results. Alternative 1 would provide no sediment reductions since none of the identified road segments would be addressed.

There are several historic mining areas located in the project area. Most were prospecting activities and had little development and are not expected to be actively eroding.

Within the project area watersheds, the ongoing activities and reasonably foreseeable projects are not expected to increase sediment contributions to this watershed. Sediment reductions would be realized primarily by improving the existing road system as proposed by this project. Regular road maintenance activities are expected to have a general beneficial effect toward aquatic resources through reduced sediment delivery and risk of road failures.

Water Temperature

The combination of direct and indirect effects of the action alternative with past, present and reasonably foreseeable activities would preserve the shade-providing riparian vegetation within the project area RHCAs. This would not further degrade water quality with respect to temperature because RHCAs would retain the canopy cover that prevents solar inputs to the stream. The riparian vegetation would continue to slowly improve as the stands grow and mature.

Cumulative Effects to Watershed Function for Alternative 2

Road Density

Road densities in the project area watersheds would have slight reductions from existing levels upon project completion, as described in the direct and indirect effects section. Road densities would increase during the implementation phase of the project as temporary roads are constructed and currently-stored roads are re-opened to accommodate project activities. Several project design features are included to minimize effects from the increased road densities during the implementation phase. No other projects located on private lands within the cumulative effects area that would increase road densities are anticipated, because road networks on those lands already exist. Road building could occur in tandem with development of homesteads on private lands, but because only several hundred acres of private land are scattered within the lower reaches of the Myrtle, Snow and Caribou Creek cumulative effects area it would not significantly change the values presented in the direct and indirect effects section.

Equivalent Clearcut Area

Cumulative effects for Equivalent Clearcut Area (ECA) take the direct effects of the harvests and road activities and combine them with the ECA that is resultant from all past and anticipated vegetation management and road activities that have occurred in project area watersheds. Timber harvest has been actively occurring on the private timberlands with most of those lands having been harvested over about the last decade. These values are included in the direct and indirect effects ECA values presented in table 10. Minimal future timber harvest activities (less than 400 acres) are anticipated in the private lands located in the project area watersheds as reported by Idaho Department of Lands. As a result of the minimal future harvest anticipated on the private lands located in the cumulative effects area, ECA values and their effects would remain as described in the direct and indirect effects section. ECA values would decline immediately after project implementation as vegetation in the previous timber harvest areas continues to recover.

Summary of Environmental Effects

The effects of the proposed actions on water quality would include the reduction of sediment delivery to project area streams through the prescribed actions of priority road maintenance, decommissioning and storing project area roads and improving riparian area shading through natural recovery (decrease in water temperature) in the riparian areas. Water quality is expected to be maintained or improve in regards to temperature and sediment delivery with the action alternative in the project area streams upon completion of this project.

Compliance with the Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

Idaho Panhandle National Forests Plan and BLM Resource Management Plan

All alternatives meet the requirements of the IPNF Forest Plan and BLM Resource Management Plan for water resources and fisheries. The reduction in sediment delivery, reduced risk of road failures, improved aquatic organism passage in Snow Creek and protection of RHCAs would all benefit aquatic resources. The hydrology project file contains information regarding compliance with specific forest plan goals, objectives, guidelines and standards.

Clean Water Act, Including State of Idaho Implementation

The proposed action would be consistent with the requirements of the Federal Water Pollution Control Act as amended by the Clean Water Act, 33 U.S.C. §1251. Water temperature would not increase in the temperature TMDL stream segments in the project area as a result of implementation of any alternative or any of the foreseeable actions. The areas along the project area streams that are identified as shade deficit segments in the TMDL will continue to grow and mature thus providing additional shade over time.

The overall net sediment reduction associated with the proposed action would also be in compliance with the sediment TMDL for Deep Creek, which is the receiving waterbody of Snow, Caribou and Fall Creeks. The Sediment TMDL calls for the reduction in sediment delivery from lands managed by the US Forest Service. Table 8 shows a summary of sediment delivery from proposed project activities and an overall reduction in sediment delivery of 8.1 tons per year from Snow Creek and 0.8 tons per year in Caribou Creek. These reductions are the maximum reduction as modeled using FS WEPP:Road that were identified from a comprehensive field review of road/stream interaction surveys within the project area watersheds. Most of the reductions would be realized by priority road maintenance activities on existing roads. The potential risk of sediment delivery from road failures would increase during the project implementation phase as roads are constructed and opened to accommodate project activities, but would not be expected to exceed the long term annual reductions achieved from priority road maintenance.

Through implementation of INFS, BMPs and the net sediment reduction that would take place, risks to beneficial uses designation for support of cold water biota, primary contact recreation and salmonid spawning in the project area streams and tributaries would be reduced by implementation of the proposed action.

Idaho Forest Practices Act

Best Management Practices or soil and water conservation practices would be applied under both alternatives, and all activities comply with the guidelines in the soil and water conservation handbook. A recent audit of BMPs pertaining to water quality indicates the USFS averaged 99% compliance with BMP rules since 1996, and identifies that BMPs are effective when properly installed (IDEQ 2020).

Idaho Stream Channel Protection Act

All alternatives would be consistent with the requirements of this act. INFS criteria incorporates specific protections for stream channels, and is included in this project.

Executive Orders 11988 and 11990

All alternatives are consistent with these EO’s regarding floodplains and wetlands. This project proposes no development within wetlands or floodplains. Further, INFS criteria incorporates specific protections for these areas, and is included in this project.

Other Agencies and Individuals Consulted

- Idaho Department of Environmental Quality – Bob Steed and Anna Moody

  Bob provided clarification on water quality issues and beneficial uses.

  Anna provided information regarding laws and rules pertaining to project activities that are proposed within the Myrtle Creek watershed, which is the municipal water supply for the city of Bonners Ferry.

- US Department of the Interior Bureau of Land Management – Mike Stevenson

  Mike provided information regarding the BLMs resource management plan as it pertains to aquatic resources.

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